

Indicator: Wetland Extent, Change, and Sources of Change (020)

Freshwater wetlands support a variety of fish and wildlife species and contribute to the aesthetic and environmental quality of the U.S. Millions of Americans use freshwater wetlands annually for hunting, fishing, bird watching and other outdoor activities. Estuarine wetlands provide valuable nursery, feeding, breeding, staging, and resting areas for an array of fish, shellfish, mammals, and birds (Dahl, 2000). In addition, wetlands serve as groundwater recharge areas and filter contaminants from surface runoff (Mitsch and Gosselink, 1986). Destruction and/or alteration of wetlands, therefore, have wide-ranging biological and hydrological impacts.

When European settlers first arrived, wetland acreage in the area that would become the lower 48 states was more than 220 million acres, or about five percent of the total area of the conterminous U.S. Since then, extensive losses have occurred, and over half of our original wetlands have been drained and filled. By 1997, total wetland acreage was estimated to be 105.5 million acres (Dahl, 2000). Of that total, nearly 95 percent or 100.2 million acres were fresh water and about five percent or 5.3 million acres were intertidal marine and estuarine wetlands. Between 1986 and 1997, 98 percent of all wetland losses in the conterminous U.S. were freshwater wetlands (Dahl, 2000).

In addition to the sheer loss of wetland acreage, major ecological impacts have also resulted from the conversion of one wetland type to another such as clearing trees from a forested wetland or excavating a shallow marsh to create an open water pond. These types of conversions change habitat types and community structure in watersheds and impact the animal communities that depend on them (Dahl, 2000).

The National Wetlands Inventory Status and Trends survey (NWI) data provide estimates of the extent of all wetlands in the conterminous U.S. Data presented are derived from three separate analyses; one covering the 1950s to the 1970s; one covering the 1970s to 1980s, and one covering the 1980s to the 1990s. The NWI counts all wetlands every 10 years, regardless of land ownership, but only recognizes wetlands that are at least three acres in size. A permanent study design is used, based initially on stratification of the 48 conterminous states by state boundaries and 35 physiographic subdivisions. Within these subdivisions are located 4,375 randomly selected, four square mile (2,560 acres) sample plots. These plots are examined with the use of aerial imagery, ranging in scale and type; most are 1:40,000 scale, color infrared, from the National Aerial Photography Program. Field verification is conducted to address questions of image interpretation, land use coding, and attribution of wetland gains or losses; plot delineations are also completed. For example, for the 1980s to 1990s analysis, 21 percent of the sample plots were field-verified.

The data estimating the causes or sources of wetland losses are from the National Resource Inventory (NRI), which is a scientifically based, longitudinal panel survey of trends in the nation's soil, water, and related resources. NRI data were collected using a variety of imagery, field office records, historical records and data, ancillary materials, and a limited number of on-site visits. The data have been compiled, verified, and analyzed to provide a comprehensive look at the state of the nation's non-federal lands. The 1997 NRI provides results that are nationally consistent for all non-federal lands (accounting for 75 percent of the nation's land area) for 1992 and 1997. The NRI captures data on over 300,000 primary sample units (nominally 160 acres each) containing over 800,000 sample points. The large sample size supports the analysis of data on a regional basis. In 2000, the NRI shifted to an annual survey in which data are collected at slightly less than 25 percent of the same sample sites. National data on sources of wetland change are presented from the 2002 NRI; however, due to the smaller sample size, the data cannot support regional analyses.

What the Data Show for Wetland Extent and Change

Rates of annual wetland losses have decreased from almost 500,000 acres a year three decades ago to less than 100,000 acres, averaged annually from 1986 to 1997 (Exhibit 020-1). The USFWS estimated the annual rate of loss at 58,500 acres per year between 1986 and 1997. This represents an 80 percent reduction compared to the previous decadal rate of loss.

Freshwater wetland types include forested, shrub, and emergent wetlands, plus open water ponds. Forested and emergent wetlands make up over 75 percent of all freshwater wetlands (Dahl, 2000). Since the 1950s, freshwater emergent wetlands have declined by nearly 24 percent – a greater proportional loss than any other freshwater wetland type (Exhibit 020-2). Freshwater forested wetlands have sustained the greatest absolute losses – 10.4 million acres since the 1950s.

Coastal wetlands are the vegetated interface between aquatic and terrestrial components of estuarine ecosystems. Estuarine emergent wetlands account for nearly 75 percent of coastal wetlands. Since the 1950s, coastal and estuarine losses were about 1.4 million acres – a nearly 12 percent decline (Exhibit 020-3). However, long-term trends indicate that loss of estuarine vegetated and non-vegetated wetland area has slowed over time.

What the Data Show for Sources of Wetland Change

Development accounted for two-thirds of wetland acreage lost on non-federal lands in the conterminous United States between 1997 and 2002 (Exhibit 020-4). Agriculture contributed to approximately 20 percent of the gross losses during the same period but was also responsible for wetland acreage gains averaging 36,000 acres per year (USDA, 2004). Between 1992 and 1997, urban, suburban, and commercial development was also the primary cause of net wetland loss, accounting for 49 percent of losses nationally (Exhibit 020-4). During this period, agriculture accounted for 26 percent of the nation's net wetland losses on non-federal lands, and timber harvesting and silviculture were the source of 12 percent of the net loss. Prior to the NRI, the NWI estimated that agriculture accounted for 81 percent of all wetlands conversions between 1954 and 1974 (Frayer et al., 1983).

Regional level data on sources of wetland loss are available between 1992 and 1997 and illustrate that sources of loss vary by region (Exhibit 020-4). For example, in the midwest and northern plains, about 50 percent of losses were from agriculture whereas the east, southeast, and south central states had the highest percentages of wetland loss due to development. In the east, 67 percent of the wetland losses were attributed to development (USDA, 2000). Regional data for the NRI are not available between 1997 and 2002.

Indicator Limitations

- This indicator does not effectively address the question of wetland condition. While it is possible to inventory wetlands that have been lost, many wetlands have suffered degradation of condition and functions, which cannot be quantified nationally.
- Different methods were used in some of the early classification schemes to classify wetland types. The classification system that is currently used by NWI was not applied to some of the earlier maps (1970s). As methods and spatial resolution have improved over time, acreage data have been adjusted resulting in changes in the overall wetland base over time. Thus, the evaluation process is evolving, which contributes to reducing the accuracy of the trends observed.
- Ephemeral wetlands and effectively drained palustrine wetlands observed in farm production are not recognized as a wetland type by NWI and are therefore not included.
- Forested wetlands are difficult to photointerpret and are generally underestimated by NWI.

- The NWI does not survey wetlands under 3 acres in size. Therefore, no record exists of the extent of, and change in, this valuable resource.
- The NWI does not include Alaska and Hawaii.
- Statistics derived from the NRI database are estimates and not absolutes. They provide information at a coarse scale, summarized by state, and are useful for national reporting. Thus, there is some amount of uncertainty, which is explained in the appendix of the report.
- The NRI data do not include an adequate sample of coastal resources.
- The NRI does not collect data on federal lands (which represent about 25% of the nation's land area) or for the state of Alaska.
- Regional data for the NRI are not available between 1997 and 2002.

Data Sources

Dahl, T.E. and C.E. Johnson. *Status and Trends of Wetlands in the Conterminous United States, Mid-1970's to Mid-1980's*, Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 1991.

Dahl, T.E. *Status and Trends of Wetlands in the Conterminous United States 1986 to 1997*, Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 2000.
<http://wetlands.fws.gov/bha/SandT/SandTReport.html>.

Frazer, W.E., T.J. Monahan, D.C. Bowden, and F.A. Graybill. *Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States, 1950's to 1970's*, Ft. Collins, CO: Colorado State University, 1983.

U.S. Department of Agriculture. *Summary Report: 2002 Annual National Resources Inventory*. Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University Statistical Laboratory, 2004. <http://www.nrcs.usda.gov/technical/land/nri02/>.

U.S. Department of Agriculture. *Summary Report: 1997 National Resource Inventory (Revised December 2000)*. Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University Statistical Laboratory, 2000. http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/.

References

Dahl, T.E. and C.E. Johnson. *Status and Trends of Wetlands in the Coterminous United States, Mid-1970's to Mid-1980's*, Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 1991.

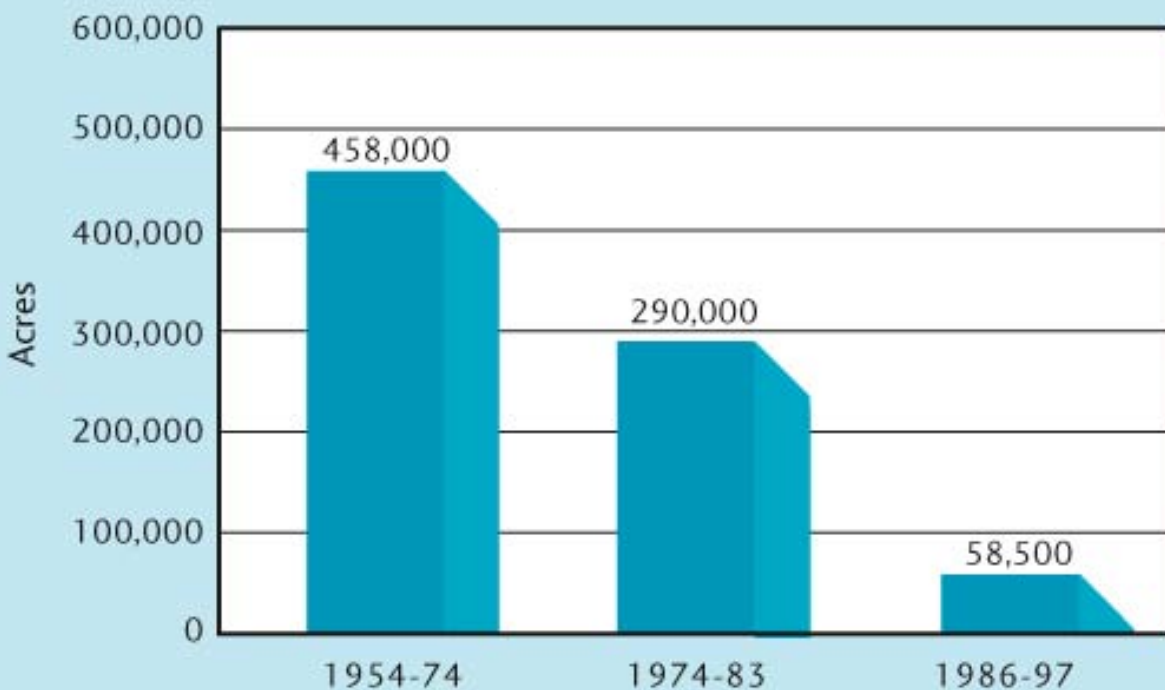
Dahl, T.E. *Status and Trends of Wetlands in the Conterminous United States 1986 to 1997*, Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 2000.
<http://wetlands.fws.gov/bha/SandT/SandTReport.html>.

Frazer, W.E., T.J. Monahan, D.C. Bowden, and F.A. Graybill. *Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States, 1950's to 1970's*, Ft. Collins, CO: Colorado State University, 1983.

Mitsch, W.J. and J.G. Gosselink. *Wetlands*. New York, NY. Van Nostrand Reinhold Company Inc. 1986.

Graphics

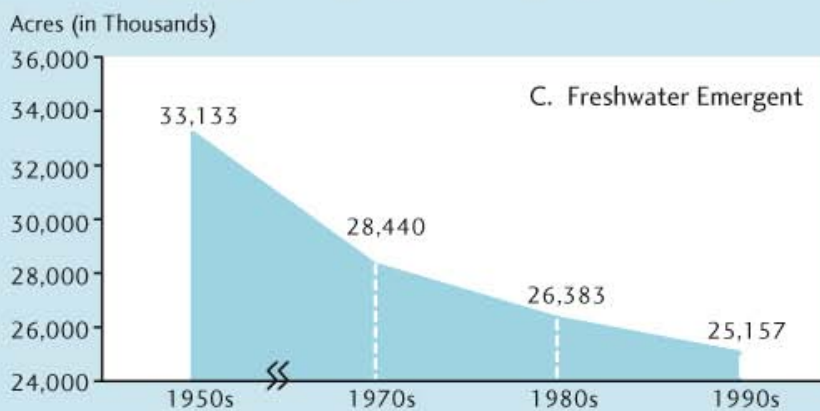
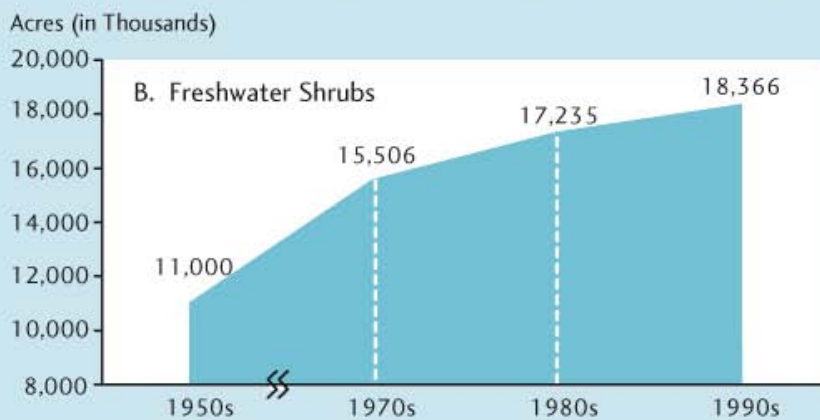
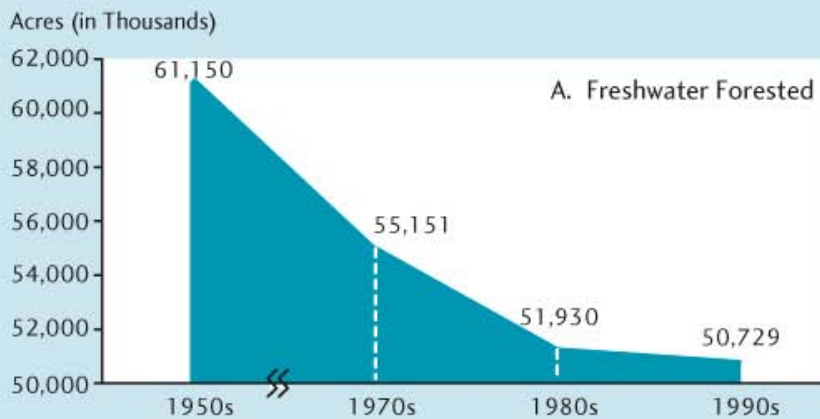
Figure O20-1: Average annual wetland loss,
1954-1974, 1974-1983, 1986-1997



Coverage: Conterminous United States

Source: Frayer et al. *Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States, 1950s to 1970s*. 1983; Dahl, T.E. and C. E. Johnson. *Wetlands Status and Trends in the Conterminous United States: 1970s to 1980s*. 1991; Dahl, T. E. *Status and Trends of Wetlands in the Conterminous United States 1986 to 1997*. 2000.

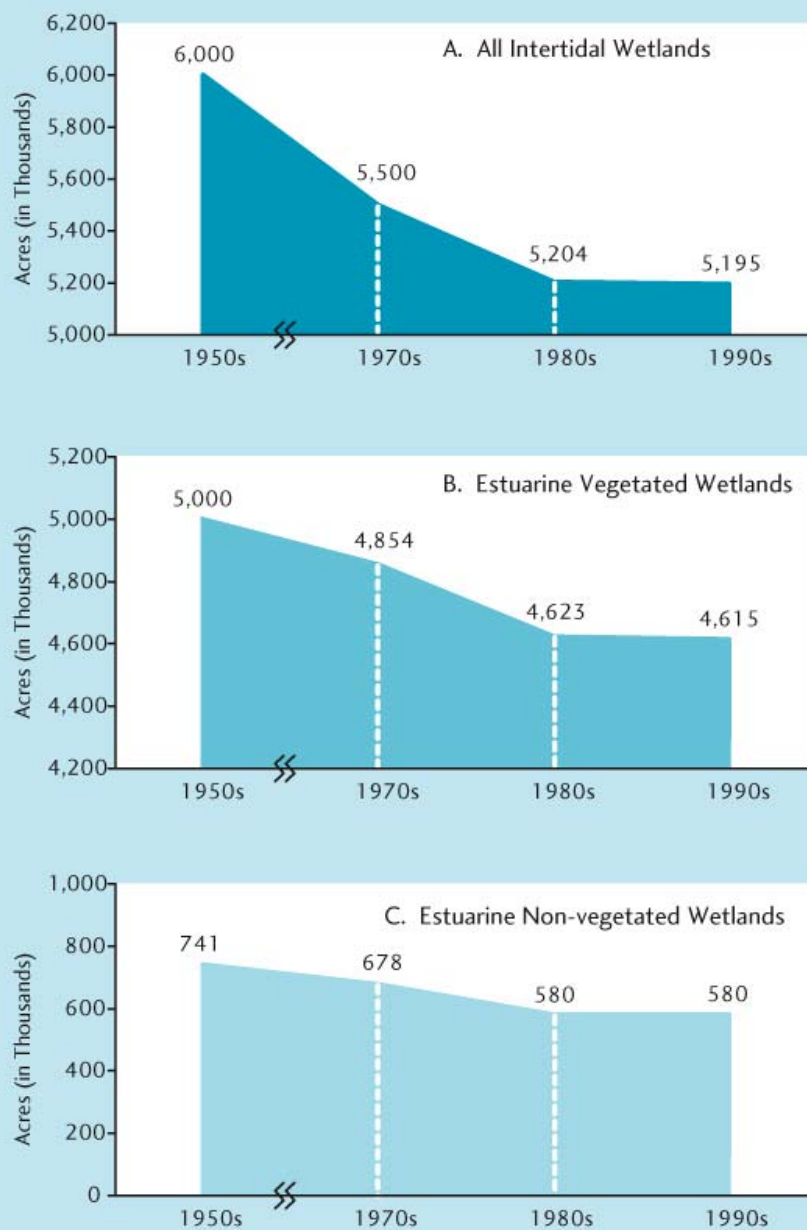
Figure O2O-2: Long-term trends in selected freshwater wetlands, 1954-1997



Coverage: Conterminous United States

Source: Frayer et al. *Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States, 1950s to 1970s*. 1983; Dahl, T.E. and C. E. Johnson. *Wetlands Status and Trends in the Conterminous United States: 1970s to 1980s*. 1991; Dahl, T. E. *Status and Trends of Wetlands in the Conterminous United States 1986 to 1997, 2000*.

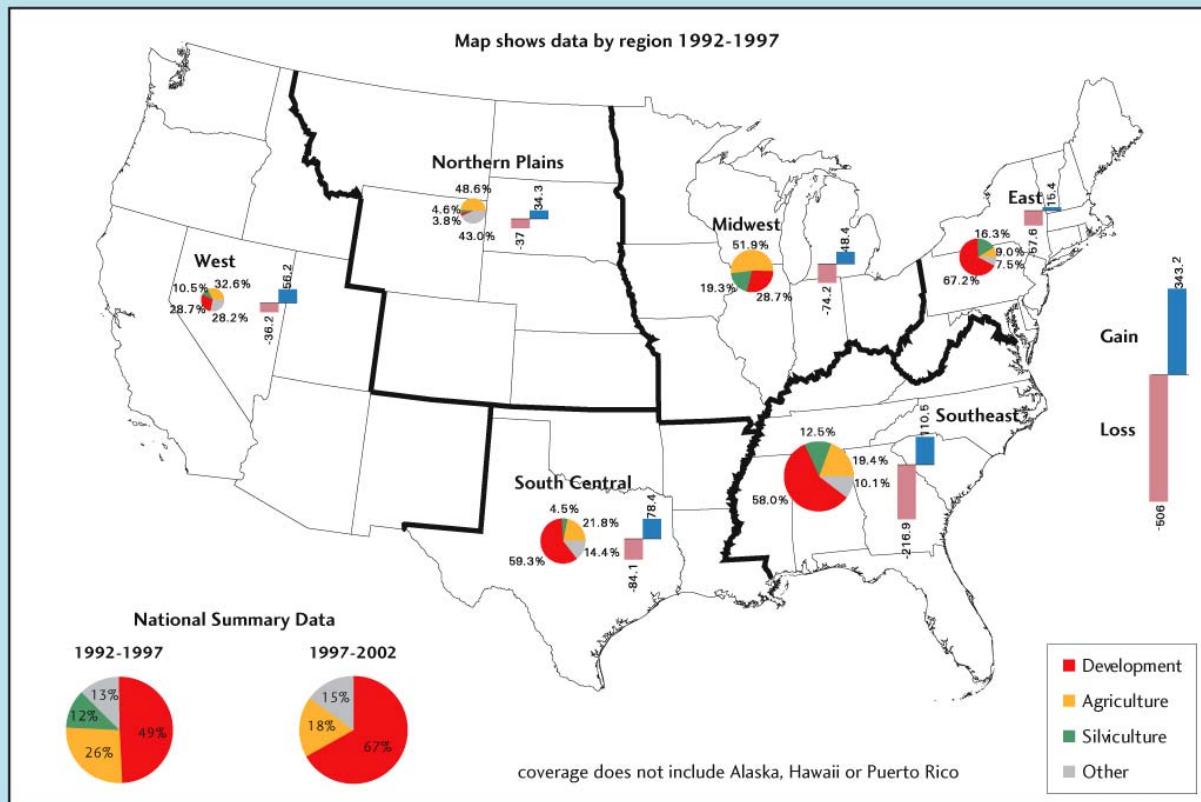
Figure O20-3: Long-term trends in selected estuarine wetlands, 1954-1997



Coverage: Conterminous United States

Source: Frayer et al. *Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States, 1950s to 1970s*. 1983; Dahl, T.E. and C. E. Johnson. *Wetlands Status and Trends in the Conterminous United States: 1970s to 1980s*. 1991; Dahl, T. E. *Status and Trends of Wetlands in the Conterminous United States 1986 to 1997*. 2000.

Figure O20-4: Reasons for conversion of wetlands on non-federal lands by region, 1992-1997, and nationally, 1992-2002



Source: Summary Report: 1997 National Resources Inventory, December, 2000, revised. Summary Report: National Resources Inventory, 2002 Annual NRI, April, 2004.

R.O.E. Indicator QA/QC

Data Set Name: WETLAND EXTENT, CHANGE, AND SOURCES OF CHANGE

Indicator Number: 020 (89138)

Data Set Source: U.S. Fish and Wildlife Service, National Wetlands Inventory

Data Collection Date: irregular: 1954-1974, 1974-1983, 1986-1997

Data Collection Frequency: every 10 years

Data Set Description: Two programs, the USFWS NWI status and trends studies and the NRCS NRI, estimate wetland extent. The USFWS surveys all wetlands in the conterminous U.S. The NRI surveys wetlands on non-federal lands, which make up approximately 75 percent of the nation's land base. The methods employed differ, but the statistical results from the most recent survey period were not significantly different. USFWS data are used for the "wetland extent and change" indicator due to their broader coverage. This indicator is derived from three separate analyses: one covering the 1950s to the 1970s; one covering the 1970s to the 1980s; and one covering the 1980s to the 1990s.

Primary ROE Question: What are the trends in the extent and condition of wetlands?

Question/Response

T1Q1 Are the physical, chemical, or biological measurements upon which this indicator is based widely accepted as scientifically and technically valid?

Yes. An interagency group of statisticians developed the design for the U.S. Fish and Wildlife Service's (USFWS) national status and trends study. Dahl, T.E. Status and Trends of Wetlands in the Conterminous United States 1986 to 1997, Washington, D.C: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 2000. <http://wetlands.fws.gov/bha/SandT/SandTReport.html>
Dahl, T.E. and C.E. Johnson. Status and Trends of Wetlands in the Conterminous United States, Mid-1970's to Mid-1980's, Washington, D.C: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 1991. <http://wetlands.fws.gov/bha> Frayer, W.E., T.J. Monahan, D.C. Bowden, and F.A. Graybill. Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States, 1950's to 1970's, Ft. Collins, CO: Colorado State University, 1983. OUT OF PRINT.

T1Q2 Is the sampling design and/or monitoring plan used to collect the data over time and space based on sound scientific principles?

Yes. The basic sampling design and study objectives have remained constant for each wetland status and trends report. The study design consists of 4,375 randomly selected sample plots (4 square miles in area) that are examined and characterized using aerial imagery provided by the National Aerial Photography Program in combination with field verification to determine wetland change and are described extensively in Dahl, 2000.
<http://wetlands.fws.gov/bha/SandT/SandTReport.html>

T1Q3 Is the conceptual model used to transform these measurements into an indicator widely accepted as a scientifically sound representation of the phenomenon it indicates?

Yes. Dahl, 2000. <http://wetlands.fws.gov/bha/SandT/SandTReport.html> The USFWS Status and Trends Reports undergo extensive interagency comment and review by Agency senior technical experts.

T2Q1 To what extent is the indicator sampling design and monitoring plan appropriate for answering the relevant question in the ROE?

The sampling design and monitoring plan meet the criteria for indicator data to answer questions in the ROE. NWI sampling encompasses all wetlands of the conterminous 48 States and Puerto Rico, including coastal wetlands. The basic sampling design and study objectives have remained constant for each wetland status and trends report, and are repeated every 10 years. The study design consists of 4,375 randomly selected sample plots (4 square miles in area) that are examined and characterized using aerial imagery provided by the National Aerial Photography Program in combination with field verification to determine wetland change. Estimates of change in wetlands were made over a specific time period (1954 to 1974, 1974 to 1983, and 1986 to 1997). <http://wetlands.fws.gov/bha/SandT/SandTReport.html>

T2Q2 To what extent does the sampling design represent sensitive populations or ecosystems?

The sampling design includes all ecosystem types, but does not capture wetlands smaller than 3 square acres.

T2Q3 Are there established reference points, thresholds or ranges of values for this indicator that unambiguously reflect the state of the environment?

No. This indicator is a surrogate for condition, which assumes that loss of wetlands indicates a declining environment. The indicator is consistent across space and time.

T3Q1 What documentation clearly and completely describes the underlying sampling and analytical procedures used?

<http://policy.fws.gov/905fw1.html> provides guidance for conducting habitat mapping by the National Wetlands Inventory. See also: Dahl, T.E. Status and Trends of Wetlands in the Conterminous United States 1986 to 1997, Washington, D.C.: U.S. Department of the Interior, U.S. Fish and Wildlife Service, 2000.

<http://www.wetlands.fws.gov/bha/SandT/SandTReport.html>

T3Q2 Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions or are there confidentiality issues that may limit accessibility to the complete data set?

The data set and supporting information are available from <http://www.wetlands.fws.gov/bha/SandT/SandTReport.html>

T3Q3 Are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

Yes. <http://policy.fws.gov/905fw1.html> provides guidance for conducting habitat mapping by the National Wetlands Inventory. <http://www.wetlands.fws.gov/bha/SandT/SandTReport.html>

T3Q4 To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

<http://policy.fws.gov/905fw1.html> NWI map production includes many quality control steps prior to releasing the final product. These are outlined at the web site provided.

T4Q1 Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

Yes. The wetland status and trends studies were based on a scientific probability sample of the surface area of the 48 conterminous States using a stratified, simple random sampling design. The statistical design including inference of data beyond spatial measurements are described in Dahl, 2000.

T4Q2 Are uncertainty measurements or estimates available for the indicator and/or the underlying data set?

Yes. Margins of error are described for each of the data sets in Dahl, 2000, Frayer et al., 1983, and Dahl and Johnson, 1991.

T4Q3 Do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the indicator?

Only to the extent that as wetland losses decline nationally, the error margin increases due to the size of the data set.

T4Q4 Are there limitations, or gaps in the data that may mislead a user about fundamental trends in the indicator over space or time period for which data are available?

This indicator does not completely answer the question of wetland condition. While it is possible to inventory wetlands that have been lost, many wetlands have suffered degradation of condition and functions, which cannot be quantified nationally. Different methods were used in some of the early classification schemes to classify wetland types. The currently used classification system was not applied to some of the earlier (1970's) map. As methods and spatial resolution have improved over time, acreage data were adjusted, resulting in changes in the overall wetland base over time. Thus, the evaluation process is evolving which contributes to reducing the accuracy of the trends observed. Forested wetlands are difficult to photointerpret and are generally underestimated by the USFWS. Ephemeral wetlands and effectively drained palustrine wetlands observed in farm production are not recognized as a wetland type by the USFWS and, therefore, are not included. Also, USFWS does not survey wetlands under 3 square acres in size; therefore, no record exists of the extent and change in these wetlands. Pacific coast estuarine wetlands are not surveyed due to the discontinuity in their patch sizes. The temporal coverage of the coastal wetland loss indicator (length of record) is not consistent across the U.S.

R.O.E. Indicator QA/QC

Data Set Name: SOURCES OF WETLAND LOSS

Indicator Number: 021 (89137)

Data Set Source: U.S. Department of Agriculture, National Resources Inventory (NRI)

Data Collection Date: 1992-1997, annually since 2000

Data Collection Frequency: 1992 and 1997, annualized since 2000

Data Set Description: Sources of Wetland Change/Loss

Primary ROE Question: What are the trends in the extent and condition of wetlands?

Question/Response

T1Q1 Are the physical, chemical, or biological measurements upon which this indicator is based widely accepted as scientifically and technically valid?

Yes. Details are available from U.S. Department of Agriculture. Summary Report: 1997 National Resources Inventory (Revised December 2000), Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University, Statistical Laboratory, 2000.
http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/.

T1Q2 Is the sampling design and/or monitoring plan used to collect the data over time and space based on sound scientific principles?

Yes. The NRI is a scientific, longitudinal panel survey of the nation's soil, water, and related resources, designed to assess conditions and trends every five years. For sources of wetland loss the NRI results are nationally consistent for all nonfederal lands for 1992 and 1997. Data collected for the 1997 NRI were based on a statistical design to sample 800,000 sample points, using photo-interpretation and other remote sensing methods and standards. Data gatherers used a variety of ancillary sources including USDA field office records, local Natural Resources Conservation Service (NRCS) field personnel, soil survey and wetland inventory maps and reports, and tables and technical guides developed by local field office staffs. Inventory procedures were developed to ensure that data reflect 1997 growing season conditions, that inventory results are nationally consistent, and that data recorded for 1992 are consistent with the 1997 determination. Intricate quality assurance procedures were developed to make sure that year-to-year differences reflect actual changes in resource conditions, rather than differences in the perspectives of two different data collection specialists or changes in technologies and protocols. The 2002 Annual NRI data are collected for slightly less than 25 percent of the same sample sites. As data from subsequent inventory years are added to the database, results will become available to support regional, state, and sub-state analyses. See http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/ and <http://www.nrcs.usda.gov/technical/land/nri02/nri02wetlands.html> (U.S. Department of Agriculture. Summary Report: 2002 Annual National Resources Inventory. Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University Statistical Laboratory, 2004.)

T1Q3 Is the conceptual model used to transform these measurements into an indicator widely accepted as a scientifically sound representation of the phenomenon it indicates?

Yes. Detailed information is available from http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/. See Appendix I: Statistical Reliability.

T2Q1 To what extent is the indicator sampling design and monitoring plan appropriate for answering the relevant question in the ROE?

The NRI database accounts for and represents the total area of the United States, but very little information is given for points on federal lands. Data are collected at statistically selected sampling sites located in all counties and parishes of the 50 states and in Puerto Rico, the Virgin Islands, the District of Columbia, and selected portions of the Pacific Basin. Data for the 1997 NRI were collected for about 800,000 sample points. Data for the 2002 NRI were collected at slightly less than 25 percent of these same sites. See http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/.

T2Q2 To what extent does the sampling design represent sensitive populations or ecosystems?

The sampling design does not try to capture sensitive ecosystems separately from other wetland types.

T2Q3 Are there established reference points, thresholds or ranges of values for this indicator that unambiguously reflect the state of the environment?

The indicator does not try to reflect the state of the environment, but rather attributes wetland acreage change to sources, such as agriculture and development. The values are consistent across space and time. Including federal lands would produce different results. http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/

T3Q1 What documentation clearly and completely describes the underlying sampling and analytical procedures used?

U.S. Department of Agriculture, Summary Report: 1997 National Resources Inventory (Revised December 2000), Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University, Statistical Laboratory, 2000. U.S. Department of Agriculture. Summary Report: 2002 Annual National Resources Inventory. Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University Statistical Laboratory, 2004. See http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/.

T3Q2 Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions or are there confidentiality issues that may limit accessibility to the complete data set?

Selected national NRI summary data are displayed in 19 tables presented in the 1997 summary report, found at: http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/. Definitions of terms are the same as for the 1992 NRI (see Appendix 3 Glossary of Selected Terms). Additional data summaries can be found at: http://www.nrcs.usda.gov/technical/NRI/1997/obtain_data.html. This site includes active links to detailed compilations of data at the state level (available from individual state Internet sites). Data from the 2002 NRI are available only in summary form, at <http://www.nrcs.usda.gov/technical/land/nri02/nri02wetlands.html>.

T3Q3 Are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

Yes. See p. 75 (Appendix I -- Statistical Reliability) of the 1997 Summary Report: http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/. Several requirements have been

established regarding the database. The primary requirements are that the final database contains all of the information that has been gathered, that tabulations can be made easily, and that users of the database do not need to understand the complexities of the estimation procedures. Also, the database must produce estimates that agree with known data. U.S. Department of Agriculture. Summary Report: 2002 Annual National Resources Inventory. Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University Statistical Laboratory, 2004.

T3Q4 To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

Data quality assurance and quality control procedures are documented and accessible in the summary report: http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/.

T4Q1 Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

Yes. See Appendix I -- Statistical Reliability in the 1997 summary report (http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/). The methods describing the 2002 Annual NRI can be found at: <http://www.nrcs.usda.gov/technical/land/nri02/>.

T4Q2 Are uncertainty measurements or estimates available for the indicator and/or the underlying data set?

Yes. The 1997 summary report (http://www.nrcs.usda.gov/technical/NRI/1997/summary_report/) describes margin of error. The 2002 report also includes this information: see <http://www.nrcs.usda.gov/technical/land/nri02/nri02wetlands.html> (U.S. Department of Agriculture. Summary Report: 2002 Annual National Resources Inventory. Washington, D.C: Natural Resources Conservation Service and Ames, Iowa: Iowa State University Statistical Laboratory, 2004.)

T4Q3 Do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the indicator?

No. The large number of samples reduces the margin of error.

T4Q4 Are there limitations, or gaps in the data that may mislead a user about fundamental trends in the indicator over space or time period for which data are available?

NRI does not include data on federal lands or from the state of Alaska. The NRI data are based on statistical sampling, but they do not include an adequate sample of coastal resources. They provide information at a coarse scale, summarized by state, and are useful for national reporting. The large number of human data collectors is a source of potential error.